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AUTHORITY

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AUTHOR: Rubinowicz, A.

TITLE: On a source-free tensor field, and its tensor potential, when associated with an electromagnetic field

PERIODICAL: Acta physica polonica, v.21, no.5, 1962, 451-468

TEXT: For incident divergence of convergent spherical waves the diffraction wave is derivable from a source-free vector field V. This is uniquely determined by the solution of the wave equation describing the incident wave. The vector potential W for the field V can be established by a simple geometric method (A. Rubinowicz, Acta phys. Polon., 21, 61 (1962)). For electromagnetic fields V and W being themselves vector fields, have to be replaced by tensorial

Card 1/3

fields and potentials. The Helmholtz-Huygens principle in Kirchhoff's electromagnetic theory was fomulated by H.A. Lorentz and Lamor (A. Rubinowicz, Die Beugungswelle in der Kirchohoffschen Theorie der Beugung, Warsaw, 1957, p.238) and also differently by F. Kottler (Ann. Phys. (Leipzig), (4) 71, 457 (1923)). However, both formulations, if applied to the Maxwell equations, are equivalent and both can be expressed in terms of two tensor fields $\hat{V}_e$ and $\hat{V}_m$ (carets denote tensors of the second rank in a three-dimensional space), which determine the electric and magnetic fields. These, in turn, are uniquely determined by a given solution of the Maxwell equations. These vector fields having vanishing divergence are derivable from tensorial potentials thereby providing two separate formulations of the electromagnetic Helmholtz-Huygens principle. These are of importance for Kirchhoff's theory of diffraction when isolated for arbitrary incidence of the light waves. An integral theorem for tensorial fields is applied

Card 2/3

analogous to Stoke's theorem for vectorial fields. Utilising the Larmor and Kottler formulations of the Helmholtz-Huygens principle, the tensorial potentials for arbitrary electromagnetic fields is derived geometrically. The author similarly derived the Miyamoto-Wolf vector potentials associated with scalar wave equations.

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